

# Teaching with Version Control

Randall J. LeVeque  
Applied Mathematics  
University of Washington

# "FINAL".doc



FINAL.doc!



FINAL\_rev.2.doc



FINAL\_rev.6.COMMENTS.doc



FINAL\_rev.8.comments5.  
CORRECTIONS.doc



FINAL\_rev.18.comments7.  
corrections9.MORE.30.doc



FINAL\_rev.22.comments49.  
corrections.10.#@\$%WHYDID  
ICOMETOGRADSCHOOL???.doc

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WWW.PHDCOMICS.COM

<http://www.phdcomics.com/comics/archive.php?comid=1531>

Students must be taught to use version control.

The sooner the better.

e.g. in first programming course,  
and used regularly in later courses

Benefits:

- For their own work
- To ease building on their work
- To contribute to software projects

Useful far beyond programming...

- Writing papers, proposals, etc.
- Collaborating on slides, posters, etc.

Important component to increase “reproducibility” in CSE...

Ability to determine exactly how scientific results were obtained.

- Basis of scientific method.
- Required for confidently building on past results.
- Critical for accountability in engineering analysis / decision making.

Standards and best practices in computational/data science are not yet well codified.

- **Experimental science:** Lab notebooks, methodology section of publications, etc.
- **Mathematics:** Proofs are required in publications.

Increasing interest in topic from funders, journals, public, ...

National Research Council workshop on

Statistical Challenges in Assessing and Fostering the  
Reproducibility of Scientific Results

February 26-27, 2015

[http://sites.nationalacademies.org/DEPS/BMSA/DEPS\\_153236](http://sites.nationalacademies.org/DEPS/BMSA/DEPS_153236)

## High Performance Scientific Computing [\[webpage\]](#)

2013:  $\approx$  50 undergrads, 70 grad students (20 online)  
+ **Coursera edition**

### Topics:

- Git, bitbucket
- Python, IPython notebooks
- bash
- Makefiles
- Fortran 90
- OpenMP
- MPI

Git used to distribute course materials,  
and for turning in all homeworks.

2014: “Flipped” the class using 2013 videos.

Two hours of lab sessions each week

## Some problems:








- Git was often used only for submission
- Didn't work collaboratively
- Software stack:

2013: Used VirtualBox VM

2014: Used **SageMathCloud**

# SageMathCloud™ -- collaboratively use Sage, IPython, LaTeX, and terminals in your browser.



-  **Mathematics:** use the best open source mathematics software (Sage, R, Octave, Python, Cython, GAP, Pari, Macaulay2, Singular, and more)
-  **Edit:** collaboratively edit Sage worksheets, LaTeX documents and IPython notebooks
-  **Program:** write, compile, and run programs in most programming languages
-  **Teach:** organize teaching a course
-  **Backup:** all files automatically snapshotted every few minutes
-  **Terminal:** full Linux account with color terminal
-  **Collaborate:** over 30,000 monthly active users

Create a free account at: [cloud.sagemath.com](http://cloud.sagemath.com)

Presentation by William Stein on March 10, 2015:

<http://uwescience.github.io/reproducible/presentations.html>



GitHub “organization”: <https://github.com/amath574w2015>

with private repositories `am574-student01`, etc.

and public repositories `am574-class`,  
and `am574-group01`, etc.

See: GitHub for Education,

<https://education.github.com/>

# Peer review

## For homework:

Used scripts to copy one file (e.g. IPython notebook) from each student's repo to a different one (some mapping)

Push to Github

Students pull, comment in notebook, push

Copy back (invert mapping), push comments

## Other tools for peer review?

Aslak Bergersen, Hans Petter Langtangen:

<https://github.com/hplgit/virtual-classroom>

# Group projects

Groups of 2 worked on projects for last few weeks.

- Collaborated via GitHub, learned to merge
- Facilitated peer review of code, reports, presentations (some via Issue Tracker)

Repositories contain all materials:

```
http://faculty.washington.edu/rjl/classes/  
am574w2015/project\_presentations.html
```

# Summary

- Version control can be incorporated into courses
- Teach collaboration too.
- Some class time must be invested
- Lots of other resources available, e.g.  
[help.github.com](https://help.github.com)  
[www.clawpack.org/git\\_resources.html](http://www.clawpack.org/git_resources.html)